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KENYON & KENYON LLP
333 W. SAN CARLOS STREET
SUITE 600
SAN JOSE, CA 95110-2731

EXAMINER	
MALEK, LEILA	
ART UNIT	PAPER NUMBER
2611	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/27/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No. 10/621,755	Applicant(s) HAN, KE	
	Examiner Leila Malek	Art Unit 2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02/16/2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-84* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10,15-24,29-38,43-52,57-66 and 71-80* is/are rejected.

7)☒ Claim(s) *11-14,25-28,39-42,53-56,67-70 and 81-84* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 July 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed on 02/16/2007 have been fully considered but they are not persuasive.

Applicant's Argument: Applicant argues, on page 16, last paragraph, that the invention, as recited in the independent claims, operates on a preamble of a known string of bits. However, in contrast, Cox discloses that the input signal relates to an aircraft control system, which has as inputs an aircraft state signal and pilot control signal, which are not necessarily known qualities.

Examiner's Answer: Examiner asserts that, Applicant in the background of invention discloses that in communication channels data often is preceded by a preamble (See page 1), wherein sampling the preamble (i.e. inherently by using a sampler) provides timing characteristics of the communication channel to enable receipt of the digital data. Applicant in the background of invention further discloses estimating of the sampled preamble (i.e. inherently by using a calculator); wherein the estimated preamble further comprises an estimated amplitude, an estimated frequency, and an estimated phase (See page 2). Therefore, all the limitations regarding to using a preamble (i.e. a known signal) to estimate the amplitude, phase, and frequency of a known input signal have already been discloses in the Applicant's background of invention. Applicant in the background of invention discloses all the subject matters claimed in the independent claims, <u>except for calculating a cost function as a function of the estimated frequency and the estimated phase; varying at least one of the estimated frequency or estimated</u>

phase to calculate a plurality of cost functions; and selecting a cost function having a minimum value, wherein the cost function having the minimum value is a function of an optimal estimated frequency and an optimal estimated phase. Hence, the secondary reference only needs to show that a cost function can be calculated as a function of the estimated frequency and the estimated phase of a known or unknown signal; carrying at least one of the estimated frequency or estimated phase to calculate a plurality of cost functions; and selecting the cost function having a minimum value. Cox discloses a minimizing technique to minimize the squared approximation error of a sampled signal (could be known or unknown) and an estimation of the sampled signal. Cox discloses (See column 3, first paragraph) a calculator for calculating a set of estimates of the amplitude, frequency, and phase of a signal that define a sine function. Cox further discloses calculating the squared approximation error (interpreted as a cost function) between the samples of the received signal and the sine function defined by a set of amplitude, frequency, and phase estimates of the received signal. Cox also discloses varying the estimated frequency and estimated phase of the sampled signal to calculate plurality of cost functions (see column 3, lines 30-33) and selecting the cost function having a minimum value, wherein the cost function having the minimum value is a function of an optimal estimated frequency and an optimal estimated phase (see column 3, lines 30-45).

Applicant's Argument: Applicant argues, on page 17, first paragraph, the present invention, as recited in the independent claims, provides a cost function having a minimum value, which is a function of an optimal estimated frequency and an optimal estimated

estimated phase. However, in contrast, Cox, does not select both an optimal estimated frequency or an optimal estimated phase.

Examiner's Answer: Examiner assert that, Cox discloses (see column 3, lines 30-45) that the feature calculator repeats the modification of the amplitude, frequency and /or phase estimates using the minimization technique, to generate different sets of estimates for successive iterations, generally reducing the approximation error with each iteration. Cox further discloses that if the feature calculator determines that a set yields an error that is less than a predetermined error level, the feature calculator designates such set as the solution set for the current time window of interval of the technique. Cox further discloses that alternatively, if a predetermined number of iterations have been performed without obtaining a set that generates an error less than error less than the predetermined error level, the feature calculator designates the solution set for the current time window as the set of amplitude, frequency, and phase that yields the smallest error (interpreted as minimum error value) relative to the samples of the aircraft state signal. Since there is no definition for "optimal frequency" and "optimal phase" in the claim; therefore the frequency and phase of a set which yields to the minimum error value, have been interpreted as optimal frequency and optimal phase.

Applicant's Argument: Applicant argues, on page 18, second paragraph, in the present invention, noise is variable that requires calculation of a cost function according to the invention as recited in the independent claims. However, in contrast, in Cox noise is not relative to estimation.

Examiner's Answer: Examiner assert that, Cox has not been used to reject any limitation regarding to the noise in the system.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-5, 15-19, 43-47, and 57-61 are rejected under 35 U.S.C. 103(a) as being unpatentable over applicants admitted prior art (background of invention), in view of Cox et al. (hereafter, referred as Cox) (5,935,177).

As to claims 1, 15, 43, and 57, applicant in the background of invention discloses that in communication channels data often is preceded by a preamble (See page 1), wherein sampling the preamble (i.e. inherently by using a sampler) provides timing characteristics of the communication channel to enable receipt of the digital data. Applicant in the background of invention further discloses estimating of the sampled preamble (i.e. inherently by using a calculator); wherein the estimated preamble further comprises an estimated amplitude, an estimated frequency, and an estimated phase (See page 2). Applicant in the background of invention discloses all the subject matters claimed in claims 1, 15, 43, and 57, except for calculating a cost function as a function of the estimated frequency and the estimated phase; varying at least one of the estimated frequency or estimated phase to calculate a plurality of cost functions; and selecting a cost function having a minimum value, wherein the cost function having the

minimum value is a function of an optimal estimated frequency and an optimal estimated phase. Cox discloses a minimizing technique to minimize the squared approximation error of a sampled signal and an estimation of the sampled signal. Cox discloses (See column 3, first paragraph) a calculator for calculating a set of estimates of the amplitude, frequency and phase of a signal that define a sine function. Cox further discloses calculating the squared approximation error (interpreted as a cost function) between the samples of the received signal and the sine function defined by a set of amplitude, frequency, and phase estimates of the received signal. Cox also discloses varying the estimated frequency and estimated phase of the sampled signal to calculate plurality of cost functions (see column 3, lines 30-33) and selecting the cost function having a minimum value, wherein the cost function having the minimum value is a function of an optimal estimated frequency and an optimal estimated phase (see column 3, lines 30-45). It would have been obvious to one of ordinary skill in the art at the time of invention to modify the Applicant's background of invention to calculate a cost function and find the optimal estimated frequency and estimated phase to reduce the error on the received signal (see column 3, paragraph 1) and improve the performance of the receiver.

As to claims 2, 16, 44, and 58, Applicant in the background of invention further shows that the preamble is sinusoidal (See paragraph 06).

As to claims 3, 17, 45, and 59, Applicant in the background of invention further shows that the preamble is sampled once for each data bit in the preamble (see paragraph 07).

As to claims 4, 18, 46, and 60, Applicant in the background of invention further shows that the sampling comprises the following calculation: $\overline{X}$ =[x_0 ... x_N] where, x_k =Asin(Φ+k.f.π/2)+ n_k , A is an amplitude value, Φ is a phase value, f is a frequency value, and n_k is a noise component of a k^{th} sample (see paragraph 06).

As to claims 5, 19, 47, and 61, Applicant in the background of invention further shows that the estimating the sampled preamble comprises the following calculation: $\overline{Y}$ =[y_0 ... y_N] where, $y_k = \hat{A}\sin(\hat{\varphi}+k.\hat{f}.\pi/2)$ (see paragraph 07).

3. Claims 6-10, 20-24, 48-52, and 62-66 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicants admitted prior art (background of invention) and Cox, further in view of Sklar (Digital Communications Fundamentals and Applications, Prentice Hall; US Ed edition (October 1, 1987), pages 27 and 28).

As to claims 6, 20, 48, and 62 Applicant in the invention disclosure makes an assumption that the channel noise has a normal distribution. However there is no advantage or benefits cited for making the above assumption. Therefore, the above-mentioned claims are interpreted as broad as possible. Regarding to claims 6, 20, 48, and 62, applicant's background of invention and Cox are silent in disclosing that the noise component of the sampled preamble has a standard deviation (δ). Sklar describes the thermal noise (interpreted as noise of the sampled preamble) as a zero-mean Gaussian random process, which has a standard deviation (δ) (see page 27, last

paragraph). It would have been obvious to one of ordinary skill in the art at the time of invention to find the standard deviation to analyze the noise and the incoming data.

As to claims 7, 21, 49, and 63 Applicant in the invention disclosure makes an assumption that the channel noise has a normal distribution. However there is no advantage or benefits cited for making the above assumption. Therefore, the above-mentioned claims are interpreted as broad as possible. Sklar describes the thermal noise (interpreted as noise of the sampled preamble) as a zero-mean Gaussian (normal) random process, which has a standard deviation (δ) (see page 27, last paragraph). It is well known that if the channel noise has a normal distribution with a mean of zero, the frequency also has a normal distribution. It would have been obvious to one of ordinary skill in the art at the time of invention to assume that noise distribution is a uniform distribution to simplify the processing of the signal.

As to claims 8, 22, 50, and 64 Applicant in the background of invention discloses that the sampled preamble can be shown as following: $x_k = A\sin(\Phi + k.f.\pi/2) + n_k$ and that the estimated sampled preamble can be shown as: $y_k = \hat{A}\sin(\hat{\varphi} + k.\hat{f}.\pi/2)$. Based on the definition of cost function, which is mean squared of the difference between a transmitted signal and an estimated signal, therefore the cost function of the signal (excluding noise) would be shown as:

$$C = \left\|\overline{X} - \overline{Y}\right\|^2 = \sum_{k=0}^{N-1}(x_k - \hat{A}\sin\hat{\Phi} + k.\hat{f}.\Pi/2))^2 = \sum_{k=0}^{N-1} x_k{}^2 + \hat{A}^2 \sum_{k=0}^{N-1}\sin^2(\hat{\varphi} + k.\hat{f}.\pi/2) -$$

$$2\hat{A}\sum_{k=0}^{N-1} x_k \sin(\hat{\varphi} + k.\hat{f}.\pi/2).$$

However the received data contains some noise, therefore the cost function has a noise component, which has been calculated as following:

By using the teachings of Sklar the pdf $p(\hat{f})$ can be expressed as (see page 28):

$p(\hat{f})= 1/\delta_f\sqrt{2\Pi}\exp\left[-1/2(\hat{f}-\bar{f}/\sigma_f)^2\right]$

To find the cost function logarithm of the both side of the above equation needs to be taken and the result would be the same as cited in claims 8, 22, 50, and 64. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to calculate the cost function as described above to reduce the error on the received signal and improve the performance of the receiver.

As to claims 9, 23, 51 and 65, Cox further discloses that each of the plurality of cost functions is calculated with a different frequency value and a different phase value (See column 3, first paragraph).

As to claims 10, 24, 52, and 66, Applicant's background of invention, Cox and Sklar are silent in disclosing that the plurality of cost functions are calculated substantially simultaneously. However, it would have been obvious to one of ordinary skill in the art at the time of invention to perform the process simultaneously to reduce the time of the signal processing and make the receiver more efficient.

4. Claims 29-33 and 71-75 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicants admitted prior art (background of invention), and Cox, further in view of Gardner et al. (hereafter, referred as Gardner) (5,805,619).

As to claims 29 and 71, Applicant in the background of invention discloses that in communication channels data often is preceded by a preamble (See page 1), wherein

sampling the preamble (i.e. inherently by using a sampler) provides timing characteristics of the communication channel to enable receipt of the digital data. Applicant in the background of invention further discloses estimating of the sampled preamble (i.e. inherently by using a calculator); wherein the estimated preamble further comprises an estimated amplitude, an estimated frequency, and an estimated phase (See page 2). Applicant in the background of invention discloses all the subject matters claimed in claims 29 and 71, except for calculating a cost function as a function of the estimated frequency and the estimated phase; varying at least one of the estimated frequency or estimated phase to calculate a plurality of cost functions; and selecting a cost function having a minimum value, wherein the cost function having the minimum value is a function of an optimal estimated frequency and an optimal estimated phase. Cox discloses a minimizing technique to minimize the squared approximation error of a sampled signal and an estimation of the sampled signal. Cox discloses (See column 3, first paragraph) a calculator for calculating a set of estimates of the amplitude, frequency and phase of a signal that define a sine function. Cox further discloses calculating the squared approximation error (interpreted as a cost function) between the samples of the received signal and the sine function defined by a set of amplitude, frequency, and phase estimates of the received signal. Cox also discloses varying the estimated frequency and estimated phase of the sampled signal to calculate plurality of cost functions (see column 3, lines 30-33) and selecting the cost function having a minimum value, wherein the cost function having the minimum value is a function of an optimal estimated frequency and an optimal estimated phase (see column 3, lines 30-

45). It would have been obvious to one of ordinary skill in the art at the time of invention to modify the Applicant's background of invention to calculate a cost function and find the optimal estimated frequency and estimated phase to reduce the error on the received signal (see column 3, paragraph 1) and improve the performance of the receiver. Applicant's background of invention and Cox disclose all the subject matters claimed in claims 29 and 71, except that the apparatus has been used in a disk drive system comprising: rotating magnetic media for storing data; a motor for rotating the magnetic media; a recording head, for transmitting data; an actuator for positioning the recording head; and a communications channel for communicating data to be stored on-or read: from the recording media. Gardner shows a disk drive system (see Fig. 18 and column 20, lines 24-51) comprising: rotating magnetic media for storing data 203; a motor 305 for rotating the magnetic media; a recording head 306, for transmitting data; an actuator 307 for positioning the recording head; and a communications channel for communicating data to be stored on-or read from the recording media. It would have been obvious to one of ordinary skill in the art at the time of invention to use the techniques described by applicant's background of invention and Cox in a disk drive system to acquire and track the correct timing of the signal (see column 2, first paragraph).

As to claims 30 and 72, Applicant in the background of invention further shows that the preamble is sinusoidal (See paragraph 06).

As to claims 31 and 73, Applicant in the background of invention further shows that the preamble is sampled once for each data bit in the preamble (see paragraph 07).

As to claims 32 and 74, Applicant in the background of invention further shows that the sampling comprises the following calculation: $\overline{X}$ =[x_0 ... x_N] where, x_k =Asin(Φ+k.f.π/2)+ n_k , A is an amplitude value, Φ is a phase value, f is a frequency value, and n_k is a noise component of a k^{th} sample (see paragraph 06).

As to claims 33 and 75, Applicant in the background of invention further shows that the estimating the sampled preamble comprises the following calculation: $\overline{Y}$ =[y_0 ... y_N] where, $y_k = \hat{A}\sin(\hat{\varphi} + k.\hat{f}.\pi/2)$ (see paragraph 07).

5. Claims 34-38 and 76-80, are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicants admitted prior art (background of invention) Cox, and Gardner, further in view of Sklar (Digital Communications Fundamentals and Applications, Prentice Hall; US Ed edition (October 1, 1987), pages 27 and 28).

As to claims 34 and 76, Applicant in the invention disclosure makes an assumption that the channel noise has a normal distribution. However there is no advantage or benefits cited for making the above assumption. Therefore, the above-mentioned claims are interpreted as broad as possible. Regarding to claims 34 and 76, applicant's background of invention, Cox, and Gardner, are silent in disclosing that the noise component of the sampled preamble has a standard deviation (δ). Sklar describes the thermal noise (interpreted as noise of the sampled preamble) as a zero-mean Gaussian random process, which has a standard deviation (δ) (see page 27, last paragraph). It would have been obvious to one of ordinary skill in the art at the time of invention to find the standard deviation to analyze the noise and the incoming data.

As to claims 35 and 77, Applicant in the invention disclosure makes an assumption that the channel noise has a normal distribution. However there is no advantage or benefits cited for making the above assumption. Therefore, the above-mentioned claims are interpreted as broad as possible. Sklar describes the thermal noise (interpreted as noise of the sampled preamble) as a zero-mean Gaussian (normal) random process, which has a standard deviation (δ) (see page 27, last paragraph). It is well known that if the channel noise has a normal distribution with a mean of zero, the frequency also has a normal distribution. It would have been obvious to one of ordinary skill in the art at the time of invention to assume that noise distribution a uniform distribution to simplify the processing of the signal.

As to claims 36 and 78, Applicant in the background of invention discloses that the sampled preamble can be shown as following: $x_k = A\sin(\Phi + k.f.\pi/2) + n_k$ and that the estimated sampled preamble can be shown as: $y_k = \hat{A}\sin(\hat{\varphi} + k.\hat{f}.\pi/2)$. Based on the definition of cost function, which is mean squared of the difference between a transmitted signal and an estimated signal, therefore the cost function of the signal (excluding noise) would be shown as:

$$C = \|\bar{X} - \bar{Y}\|^2 = \sum_{k=0}^{N-1}(x_k - \hat{A}\sin\hat{\Phi} + k.\hat{f}.\Pi/2))^2 = \sum_{k=0}^{N-1} x_k^{\ 2} + \hat{A}^2 \sum_{k=0}^{N-1}\sin^2(\hat{\varphi} + k.\hat{f}.\pi/2) -$$

$$2\hat{A}\sum_{k=0}^{N-1} x_k \sin(\hat{\varphi} + k.\hat{f}.\pi/2).$$

However the received data contains some noise, therefore the cost function has a noise component, which has been calculated as following:

By using the teachings of Sklar the pdf $p(\hat{f})$ can be expressed as (see page 28):

$$p(\hat{f}) = 1/\delta_f\sqrt{2\Pi}\ \exp\left\lfloor -1/2(\hat{f}-\bar{f}/\sigma_f)^2 \right\rfloor$$

To find the cost function logarithm of the both side of the above equation needs to be taken and the result would be the same as cited in claims 36 and 78. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to calculate the cost function as described above to reduce the error on the received signal and improve the performance of the receiver.

As to claims 37 and 79, Cox further discloses that each of the plurality of cost functions is calculated with a different frequency value and a different phase value (See column 3, first paragraph).

As to claims 38 and 80, Applicant's background of invention, Cox, Gardner and Sklar are silent in disclosing that the plurality of cost functions are calculated substantially simultaneously. However, it would have been obvious to one of ordinary skill in the art at the time of invention to perform the process simultaneously to reduce the time of the signal processing and make the receiver more efficient.

Allowable Subject Matter

6. Claims 11-14, 25-28, 39-42, 53-56,67-70, and 81-84 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Leila Malek whose telephone number is 571-272-8731. The examiner can normally be reached on 9AM-5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mohammad Ghayour can be reached on 571-272-3021. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Leila Malek
Examiner
Art Unit 2611

L.M

M. G.
MOHAMMED GHAYOUR
SUPERVISORY PATENT EXAMINER